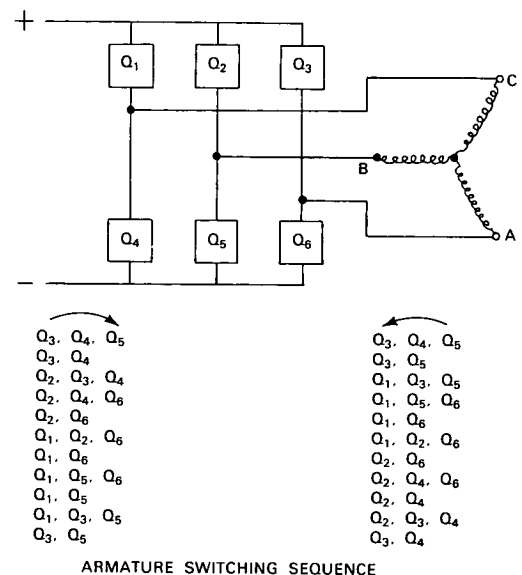
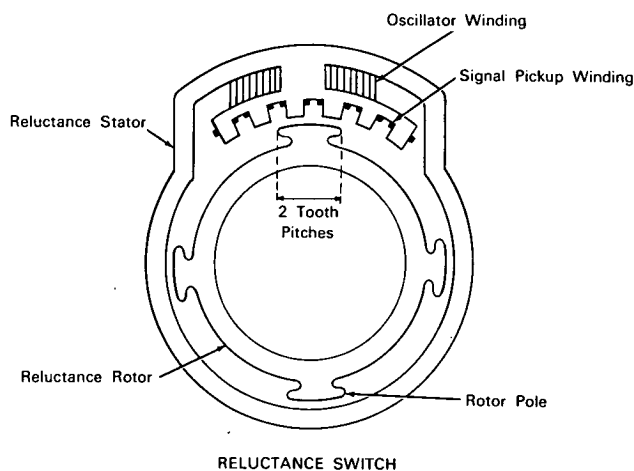


# NASA TECH BRIEF



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## Rotor Position Sensor Switches Currents in Brushless DC Motors



**The problem:** In conventional brushless dc motors, the method of sensing rotor position and switching armature circuits requires two power switches for each switching step. Consequently, the number of steps (or equivalent commutator bars) is limited by practical considerations and an undesirable amount of torque ripple results.

**The solution:** A reluctance switch incorporated in a wye-connected, three-phase, eight-pole induction motor. The reluctance switch drives a bridge rectifier that feeds a sequence of six switching transistors that determine the direction of rotation.

**How it's done:** An oscillator excites the magnetic structure of the reluctance switch. The magnetic path

is completed through the rotor poles and the reluctance switch teeth that are aligned with them. Signal pickup windings on the teeth are excited or not excited, depending on the position of the rotor. These signals operate the bridge rectifier and associated switching transistors.

Referring to the figures, it may be seen that if the 6 signal pickup windings are connected to the proper switch in the bridge, a 12-step switching sequence will occur 4 times (once for each rotor pole) during each revolution of the rotor. This makes an 8-pole winding and switching sequence the equivalent of 48 commutator bars on a conventional brushless dc motor. As a result, this motor operates with a very low level of torque ripple.

(continued overleaf)

**Notes:**

1. This motor and switching device are being used to drive the solar array system of an unmanned space satellite.
2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
Goddard Space Flight Center  
Greenbelt, Maryland, 20771  
Reference: B65-10151

**Patent status:** NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Westinghouse Electric Corporation  
under contract to Goddard Space Flight Center  
(GSFC-315)